National Institute of Environmental Health Sciences

# Effects of extreme spring temperatures on urban phenology and pollen production: A case study in Munich and Ingolstadt

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**Year:** 2011
**Journal:** Climate Research. 49 (2): 101-112

**Abstract:**

Extreme temperatures have a notable effect on phenology, much greater than expected from the general rule that low temperatures lead to a later-and high temperatures to an earlier-onset of phenological phases. The latter phenomenon can be seen when comparing urban areas with their rural surroundings: plants flower earlier in cities due to the urban heat island effect that contributes to higher temperatures. We investigated the effects of extreme temperatures on differences between urban and rural phenology and on human health (considering allergenic plants) in 2009 using phenological observations of flowering and leaf unfolding of birch Betula pendula Roth and flowering of horse chestnut Aesculus hippocastanum L. in the cities of Munich and Ingolstadt, Germany. Temperatures recorded in Munich during April 2009 were the second highest since records began in 1955 and led to rapid plant development whereas differences between urban and rural phenology were diminished. Laboratory examination of birch pollen grains revealed that the amount per catkin did not differ significantly between the city of Munich and the surrounding countryside. Long-term observations (1951/1955 to 2008, German Meteorological Service) were used to study the differences in flowering onset times between Munich and its surroundings. We found that weather conditions lasting only a few days can influence phenological behaviour, especially at the micro- and mesoscale. High temperatures, mainly extreme warm spells, were more likely to result in simultaneous flowering in urban and rural environments; low temperatures resulted in a longer delay in phenological onset times for flowering in Munich.

**Source:** http://dx.doi.org/10.3354/cr01022

## Resource Description

**Exposure :**

weather or climate related pathway by which climate change affects health

Air Pollution, Temperature

**Air Pollution:** Allergens

**Temperature:** Extreme Heat

**Geographic Feature:**

resource focuses on specific type of geography

Rural, Urban

**Geographic Location:** ☑

resource focuses on specific location

Non-United States

**Non-United States:** Europe

**European Region/Country:** European Country

**Other European Country :** Germany

**Health Impact:** ☑

specification of health effect or disease related to climate change exposure

Respiratory Effect

**Respiratory Effect:** Upper Respiratory Allergy

**Mitigation/Adaptation:** ☑

mitigation or adaptation strategy is a focus of resource

Adaptation

**Resource Type:** ☑

format or standard characteristic of resource

Research Article

**Timescale:** ☑

time period studied

Time Scale Unspecified

**Vulnerability/Impact Assessment:** ☑

resource focus on process of identifying, quantifying, and prioritizing vulnerabilities in a system

A focus of content